

Quasi-product forms for Lévy-driven fluid networks.

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Abstract

Abstract We study stochastic tree fluid networks driven by a multidimensional Lévy process. We are interested in (the joint distribution of) the steady-state content in each of the buffers, the busy periods, and the idle periods. To investigate these fluid networks, we relate the above three quantities to fluctuations of the input Lévy process by solving a multidimensional Skorokhod problem. This leads to the analysis of the distribution of the componentwise maximums, the corresponding epochs at which they are attained, and the beginning of the first last-passage excursion. Using the notion of splitting times, we are able to find their Laplace transforms. It turns out that, if the components of the Lévy process are ‘ordered’, the Laplace transform has a so-called quasi-product form.

The theory is illustrated by working out special cases, such as tandem networks and priority queues.